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ABSTRACT

This monograph is intended for use by vocational teachers, state supervisors, administrators, and curriculum developers as a resource guide in the development of sound curriculum for vocational programs in Arizona. It examines learning theories and principles and, where applicable, applies these ideas to vocational education. Chapter 1 introduces the topics of learning theories as teaching tools and their application. Each of the following eight chapters highlights a different learning theorist and identifies examples for vocational education teachers. After a brief overview of the learning theory in each chapter, specific principles are stated and outlined. These principles summarize the central idea expressed by the given theorist. The theorists are B. F. Skinner, Robert M. Gagne, Albert Bandura, Jerome Bruner, David P. Ausubel, Carl Rogers, Jean Piaget, and Robert Havighurst. Chapter 10 summarizes chapters 2-9 and again offers practical applications for vocational education. A listing of references is appended. (YLB)

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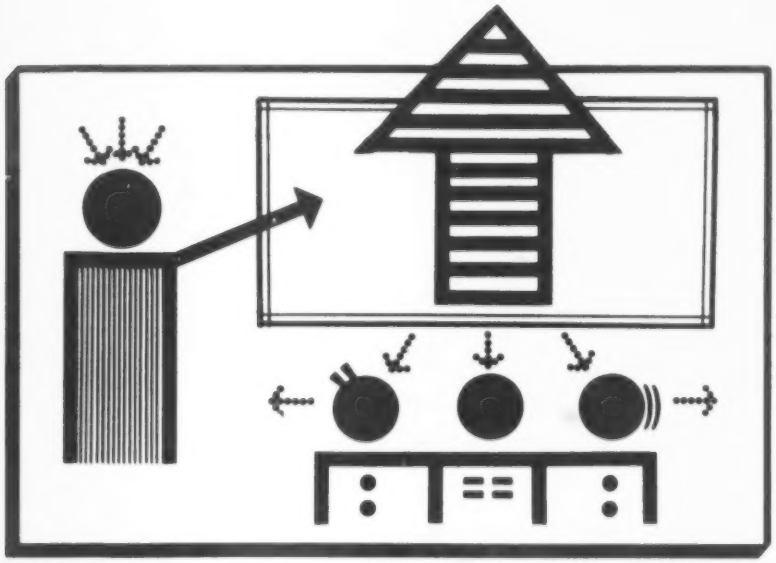

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APPLYING LEARNING PRINCIPLES AND THEORIES TO VOCATIONAL EDUCATION

by

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FOREWORD

This monograph is intended for use by vocational teachers, state supervisors, administrators and curriculum developers. It will serve as a resource guide in the development of sound curriculum for vocational programs in Arizona.

When vocational teachers have a solid background in learning principles and theories, they possess a set of tools to use in constructing a wide variety of meaningful learning situations. All learning principles and theories have something to contribute to vocational education. For example, Skinner has much to offer in his theory of small learning steps combined with immediate reinforcement. Cognitive theorists such as Bruner provide helpful ideas for discovery learning. No one theory of learning explains all the facets of the learning process as they apply to vocational education and teaching, but the theories complement each other in placing emphasis on various aspects of learning.

As a guidebook, this monograph examines learning theories and principles and where applicable, applies these ideas to vocational education.

Special thanks are extended to Charlotte Prickett for her fine contributions to this monograph. Additionally, thanks is due to Dorothyanne Peltz and Karen Zopf for their careful attention to detail and for their investment of long, tedious hours to meet production deadlines.

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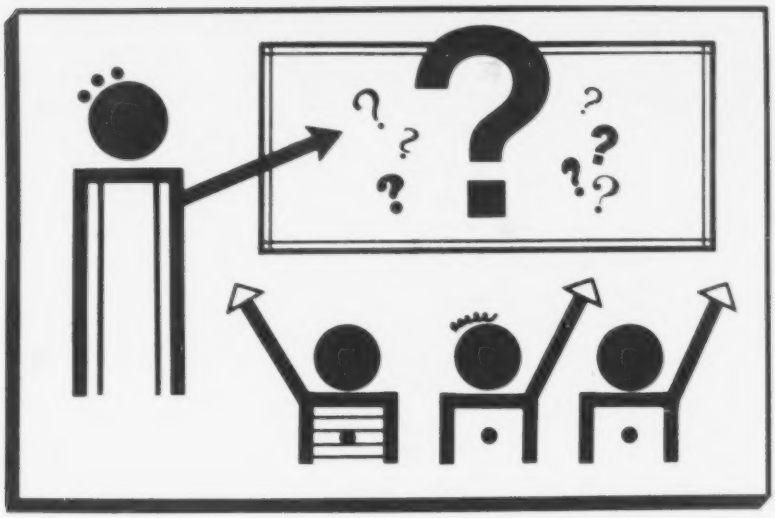
Chapter 1.

Introduction



Various educators define learning theories and principles in different ways. The following statements provide definition for the way these terms are used in this monograph. Webster's Third New International Dictionary defines learning as "...acquisition of knowledge or skill" (Neilson, 1961 p. 1408). Learning is also defined as, "relatively permanent change in behavior" (Page & Thomas, 1977, p. 202) and "the acquisition or modification of a response that results from experience" (Thornburg, 1984, p. 516). Theory, as defined by Thornburg, is "a principle or generalization that explains phenomena" (1984, p. 520), and principles are defined as "a source, or origin that from which anything proceeds" (Neilson, 1961, p. 1966).

Learning Theories as Teaching Tools

Teaching is a complex and difficult task. Teachers are faced with numerous decisions regarding the design and delivery of instruction. A sound knowledge of learning principles and theories will greatly help teachers make decisions about instruction. Understanding learning principles and theories is also important for the successful delivery and management of instruction. Meaningful instruction requires that the teacher arrange the learning environment in such a way that students achieve educational objectives most effectively. These important phases of teaching are

critically dependent upon knowledge of the learning process and the major principles of learning.

Applying Learning Theories

This monograph is designed to help teachers develop a set of principles and theories about learning and to help teachers apply these ideas while interacting with students. While learning theories and principles cannot be expected to determine step-by-step procedures, they, nevertheless, provide direction, options and priorities for teachers.

The theories and principles of learning presented in this monograph have been gleaned from educational psychology literature. All of the main theorists have been selected because of their applicability to vocational education. Where possible, attempts are made to provide illustrations and examples of actual vocational classroom applications which tend to typify or demonstrate the practical implication of each principle.

An understanding of learning theories and principles does not lead to the use of standardized procedures of instruction nor is it likely to furnish a "single best" procedure that can be applied in all teaching situations.

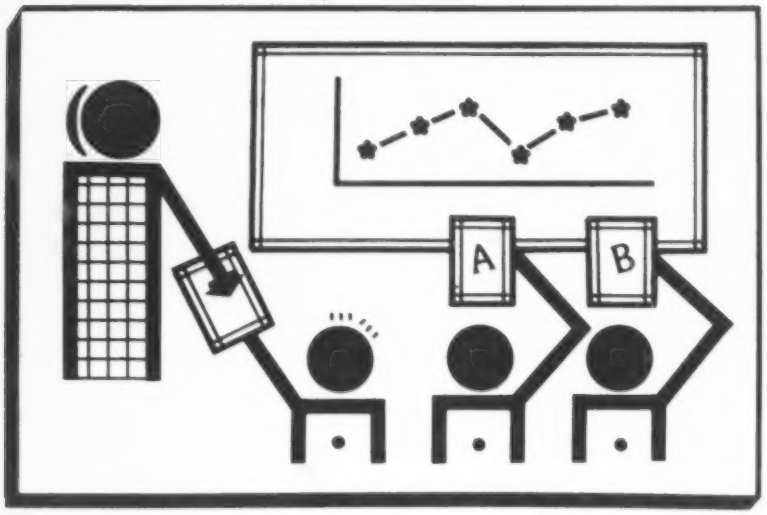
After reading this monograph, it will become apparent that there are many theories concerning the learning process. Some theories supplement others. Various theories are more appropriate than others for certain kinds of activities.

Teachers must decide which learning theories and principles are relevant for a given subject area or to their own style of teaching. They must also decide how to apply these principles and theories in order to enhance the total learning experience of vocational students.

Each of the following chapters, 2-9, highlights a different learning theorist and identifies examples for vocational education teachers. After a brief overview of the learning theory in each chapter, specific principles are stated and outlined. These principles summarize the central idea expressed by the given theorist. The last chapter summarizes chapters 2-9 and again offers practical applications for vocational education.

Chapter 2.

Learning Principles & Theories of B. F. Skinner



Behaviorists such as Skinner oppose introspective methods to study learning. Rather, they favor the study of observable behavior. This chapter summarizes Skinner's main learning principles and theories and offers suggestions for vocational education.

Skinner's Operant Learning

Skinner's classical example of his stimulus-response theory is known as the "Skinner box." In this example a rat was taught to make the correct movement for a reward, and punishment was incurred for making an incorrect movement. From a survey of the literature it can be seen that Skinner tends to basically rely on habits (practice) and immediate feedback (reinforcement) to accomplish learning.

BREAK LEARNING INTO SMALL STEPS ORGANIZED INTO A LOGICAL SEQUENCE

Skinner acknowledges that learning is a process of conditional reinforcement for given actions. Thus, according to Skinner, when we perform a set of motions or actions, and reinforcement occurs, the likelihood of our repeating the motions is increased (Bigge, 1968).

The teacher's major role as stated by Skinner is to design small learning steps. Teachers should break down subject matter into small, discrete steps and then carefully organize these steps into a logical sequence in which ideas can be learned readily by students. Each step builds deliberately upon the preceding one. Skinner advocates the use of programmed instruction to shape students' learning. Through a system of programmed instruction, learners progress through a sequence of steps at their own rate and they are reinforced immediately after each step. Reinforcement consists of either being given the correct response immediately after responding, or being permitted to proceed to the next step after registering the correct response.

Programmed textbooks and computer educational tutorial software are appropriate means of learning content according to Skinner. These instructional devices present finely detailed content which incorporates frequent and immediate reinforcements for the student. In the following example, electronics content is broken down into small, detailed sets of information.

Students cover the words on the right and after reading the content on the left hand side of the page, they try to insert the correct word to complete each item. Students receive immediate feedback regarding each answer by checking the correct responses from the right hand side of the page.

Figure 1. Programmed instruction for electronics.

Sentence to be Completed	Word to be Supplied
1. The important parts of a flashlight are the battery and the bulb. When we "turn on" a flashlight, we close a switch which connects the battery with the _____.	bulb
2. When we turn on a flashlight, an electric current flows through the fine wire in the _____and causes it to grow hot.	bulb
3. When the hot wire glows brightly, we say that it gives off or sends out heat and _____.	light
4. The fine wire in the bulb is called a filament. The bulb "lights up" when the filament is heated by the passage of a(n) _____current.	electric
5. When a weak battery produces little current, the fine wire, or _____, does not get very hot.	filament

(Source: Skinner, 1958, p. 973)

PROVIDE FREQUENT FEEDBACK TO STUDENTS

In educational settings Skinner believes that there is too great a lapse of time between behavior and its reinforcement. He also states that reinforcement of desired behavior occurs much too infrequently (Biggs, 1964).

Skinner asserts that in order for students to learn proper responses, they should receive frequent reinforcement. He thinks that if behavior is immediately reinforced, it tends to be learned and repeated. According to Skinner, reinforcement does not mean reward. For the student, simply knowing that a response is correct is sufficient.

For Skinner, a grade on a test taken near the end of the week is too far away from the behaviors the student emitted in studying the subject matter earlier in the week. For optimum learning to occur, Skinner believes that reinforcing stimuli should immediately follow the response. One way to incorporate Skinner's immediate feedback principle into vocational education classrooms would be to have students exchange papers with each other and then grade each other's work. In this way students receive immediate feedback regarding right and wrong responses during the same class period, not two weeks later after the teacher has scored, recorded and returned the papers.

Reinforcement of learned behavior should not stop after the student has learned something. Based on Skinner's theories, after a student has learned something, further reinforcements are needed so the behavior is maintained. Just because a student has mastered a competency when tested does not mean, according to Skinner, that the student will retain this behavior. Therefore, important behaviors must be continually reinforced so the student does not forget the behavior. For example, when occupational child care workers learn to provide positive guidance techniques to pre-school children, it cannot be assumed that one demonstration of this competency is sufficient to insure that these workers will keep using the technique. Skinner reminds us that students need follow-up experiences to reinforce and maintain learned responses.

INVOLVE LEARNERS AS ACTIVE PARTICIPANTS

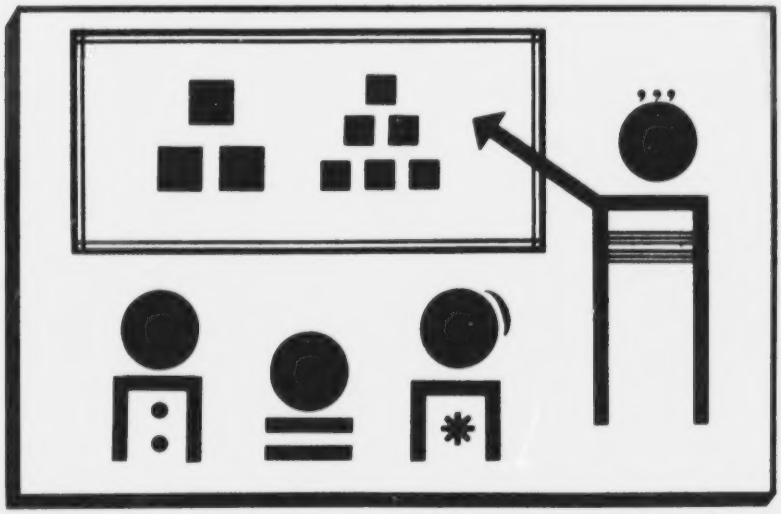
Skinner is critical of traditional education which makes students passive receivers of instruction. He emphasizes the significance of the student's involvement in the learning process. Thus, he emphasizes the significance of the student's responses and stresses that students should be active rather than passive listeners or viewers (Hilgard, 1975, p. 608).

According to Skinner, vocational education teachers should plan lessons to elicit student responses during the learning experience. When teachers prepare written materials for students to read, they should frequently interject questions or case problems to encourage active recall and application of the new information. Also during lectures the teacher should frequently check for understanding by encouraging active participation and involvement from learners.

Skinner's concept of active involvement then, suggests that the teacher break the learning into small steps, provide immediate feedback, and actively involve learners in the learning task. For example, the initial lesson in typing a business letter illustrates this learning theory. After displaying a model of a business letter: (1) The teacher indicates where the date is typed and asks the students to type the date. (2) The teacher and students return the carriage and count down an appropriate number of spaces. (3) The teacher describes the inside address, which is immediately typed by the class. (4) The salutation is explained and typed. (5) The body and closing parts of the letter are handled in the same fashion. (6) The teacher asks the students to name the various parts of the completed business letter. This step-by-step method allows the learners to become active participants in the learning process rather than serve as an audience for the teacher (Moskovis & De Young, 1974, pp. 28-29).

Chapter 3.

Learning Principles & Theories of Robert M. Gagne



Gagne believes that learning and instruction should be well designed and systematic. In order to deal with the complex aspect of learning, he breaks the process of learning into specific steps. In the design of instruction, teachers, according to Gagne, should build from simple to more complex behaviors. Gagne further states that there are many outcomes of instruction and that testing tools must match the level of expected learning outcome. This chapter highlights each of Gagne's major principles and cites practical examples for vocational education.

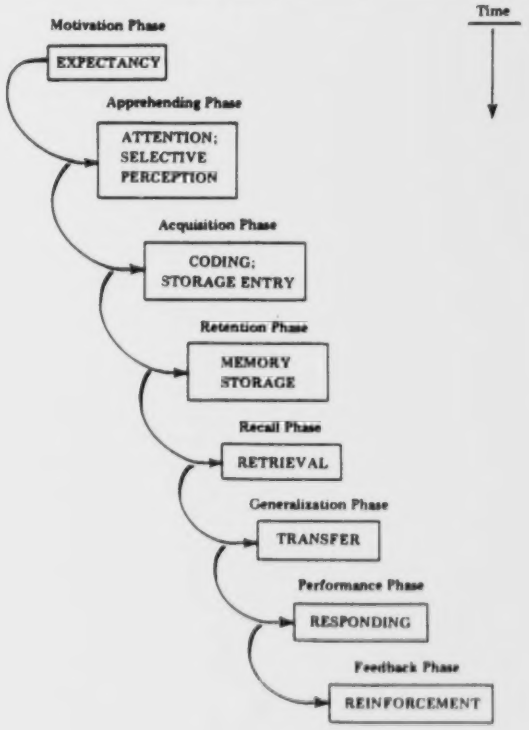
Gagne's Hierarchical Learning

Gagne views learning as cumulative and orderly. He believes that all learning is not alike. Instead, Gagne proposes that learning is divided into eight types or phases. The phases are arranged in a hierarchy because each depends on the earlier ones (Hilgard, 1975).

PLAN INSTRUCTIONAL SEQUENCES TO PARALLEL A HIERARCHY OF LEARNING

In order for classroom instruction to be meaningful, Gagne urges teachers to consider each phase of learning as they develop instructional units. Sometimes the phases are so easy to complete that they are hardly noticed. Sometimes the phases are very difficult and may require special techniques, demonstration, etc. for their successful achievement. Each of these phases is illustrated in Figure 2 and summarized on the following pages.

Figure 2. The phases of learning and the processes associated with them.



(Source: Gagne, 1974, p. 28)

Motivational Phase. In order for learning to occur the student must be motivated. Teachers nurture learners' natural desire to achieve when they establish realistic learning activities and help learners develop practical goals. For the learning that takes place in the classroom, the goals that are possible to achieve are many and varied-completing a set-in sleeve, typing a manuscript, taking a temperature, planting a landscape. All these activities may lead to achievable goals that promote learning.

Apprehending Phase. Once learners are motivated to learn, they must next grasp the instruction presented. This includes not only attending to the instruction but also perceiving the appropriate features. The learner, new to a situation, will often pay attention to unimportant aspects of that situation and miss many important ones. The teacher may say, "listen to the next two words I say to see if they are different" as an example of using verbal cues to stimulate the process of attending. In vocational classrooms where instructional packets or modules are used, the teacher can use varying sizes of type and intersperse pictures to hold the learner's attention.

Acquisition Phase. During the acquisition phase the learner stores the new knowledge in short term memory. Nearly always, what is remembered and stored by the learner is not exactly the same as the original situation. The new material is sometimes distorted in certain ways, sometimes simplified and sometimes embellished.

Gagne believes that material is stored more successfully when it is connected to an already learned event. For example, in food service classes, the learner is more likely to learn the role of calories in human nutrition if the teacher offers an analogy as a coding scheme, "calories are our body's fuel like gasoline is a car's fuel." Because knowledge can be distorted when learners code and store it, the vocational teacher should make frequent checks for understanding. Another tactic to enhance the learner's coding and storage capabilities is to use multiple stimuli. For example, in ornamental horticulture, if the teacher wants the learners to learn the techniques for making a small garden seem larger, the teacher will state the techniques and also show photographs exemplifying the use of the techniques.

Retention Phase. Once information is coded and entered into storage, it is retained in long-term memory for later recall. As Gagne points out in his book, Essentials of Learning for Instruction (1974, p. 36), the

characteristics of this phase are very difficult to determine. The main problem is that in order to find out if something has been retained, the learner must recall it. If the learner does not recall something, however, the failure may be due to one of two things; either it was not retained or there was an inadequate attempt to recall it.

Recall Phase. In this phase, the learner searches through memory storage for the information needed to deal with whatever situation is at hand. In searching for this information, the learners will rely on retrieval cues such as models, charts and explanations. These cues may be provided by either the student or the environment.

Initially, cues will have to be supplied by the teacher. As students gain sophistication, however, they will become independent of the instructor and select appropriate external cues on their own. For students working with chemicals, a number of cues can be used to help them recall whether it is acid that should be added to water or water to acid. These cues include posters, explanations and films showing the proper procedure.

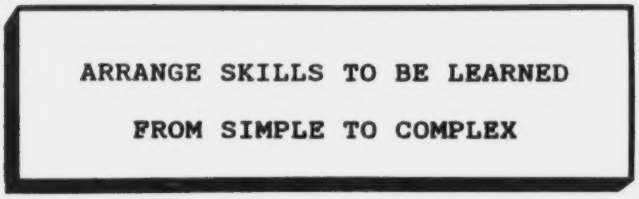
Generalization Phase. Rarely does one wish to educate a learner to deal with only a single situation. Vocational students need to be able to sell a variety of products, to set the timing correctly on many different types of engines and to raise diverse crops. That is, learners need to transfer their knowledge to situations that differ from those in which they were trained but to which their knowledge is applicable.

According to a study cited by Gagne (1974), learners will experience greater transfer of learning if they are taught rules or principles. For example, in food service, learners will be more successful at transferring old knowledge to new situations if they learn principles (some theorists use the term generalization), such as "excess heat and/or prolonged cooking will toughen protein foods," rather than learning a fact such as "cook a roast at 325 degrees for 3 hours."

Performance Phase. Only through student performance can the teacher determine whether or not learning has taken place. "Can students do what the teacher was supposed to teach them to do?"--that is the important question. The only way to find out is to ask the learner to perform tasks that require use of the knowledge, attitude or skill. This is the end product in competency based education, the demonstrated achievement of the task(s).

Usually a single instance of performance is not entirely convincing. If the environment permits, two or three displays of the performance are better evidence that the intended learning has occurred. Also learning must be demonstrated by each learner, not a group of learners. For example, if changing a tire is a required behavior, each learner must demonstrate mastery of that behavior.

Feedback Phase. Based on the performance of the student, the teacher can formulate feedback. This feedback will inform students of the quality of their performance and suggest ways to make necessary improvements. The "learning loop" is closed by reinforcement. The state of expectancy established during the motivational phase results in feedback that confirms this expectancy.



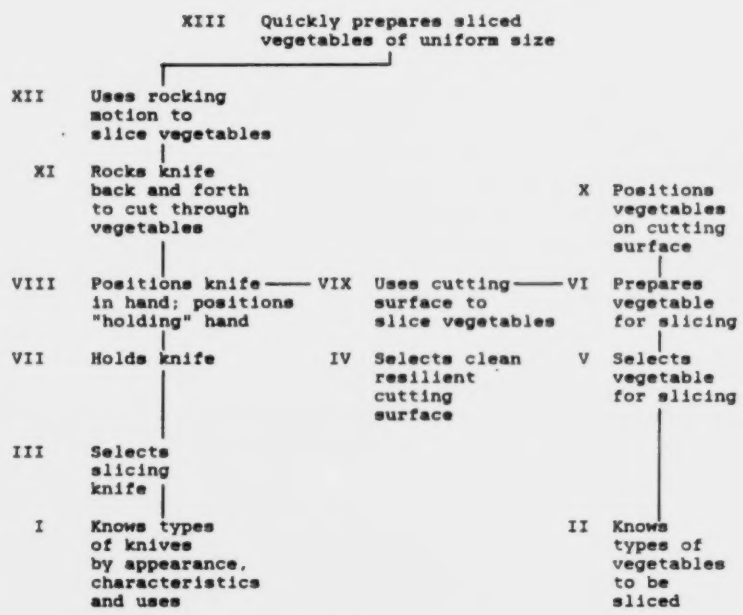
Gagne believes that learning should progress from simple learnings to more complex learnings. He contends that students learn higher level skills more easily if they have mastered the simple or subordinate skills.

Teaching and learning, according to Gagne, should proceed based on his hierarchical structure such that the higher levels of learning within the sequence are arrived at after mastery of the lower levels. For example, in agricultural education the basic principles of animal feeding could be taught before teaching students how to balance a ration.

In business education, a student may be asked to type a letter from copy presented in model form in a textbook. After mastering that task, the student may be asked to type a letter from copy in which the form has not been arranged. Upon mastery of that task, the student may be asked to type a letter from copy that is unarranged and in addition needs to have the necessary punctuation and capitalization supplied. In such procedures, the student starts with a relatively simple task and then proceeds to the more difficult as each succeeding task is mastered (Schramm, 1978, p. 17).

A learning hierarchy of a given competency illustrates which skills are prerequisite and, therefore, must be mastered before other skills. An example of a learning hierarchy for slicing vegetables is illustrated below:

Figure 3. A learning hierarchy for slicing vegetables


XIII Quickly prepares sliced vegetables of uniform size
XII Uses rocking motion to slice vegetables
XI Rocks knife back and forth to cut through vegetables
VIII Positions knife in hand; positions "holding" hand
VIX Uses cutting surface to slice vegetables
VI Prepares vegetable for slicing
X Positions vegetables on cutting surface
VII Holds knife
IV Selects clean resilient cutting surface
V Selects vegetable for slicing
III Selects slicing knife
I Knows types of knives by appearance, characteristics and uses
II Knows types of vegetables to be sliced

Use of learning hierarchies is a promising practice for vocational teachers. The development of learning hierarchies will assist teachers in diagnosing individual learners' needs. Hierarchies of this type break a given competency into manageable units that can further serve as specific lesson plans. Lesson plans can be designed for a level 1 (beginner), level 2 (intermediate), or level 3 (advanced) learner. Further, learning hierarchies assist learners in mastering a given competency by forcing the learner to recall and use each subordinate skill in the total mastery of a new competency.

RECOGNIZE MULTIPLE AIMS FOR INSTRUCTION

According to Gagne, students learn a variety of capabilities through instruction. He believes that these capabilities or learning outcomes are categorized as intellectual skills, cognitive strategies, verbal information, motor skills, and attitudes.

Gagne further states, "concentrating instruction on any one type of capability alone, or any two in combination, is insufficient" (Gagne, 1974, p. 12). Thus, based on Gagne, multiple aims for instruction must be recognized. Learners need to attain several varieties of learned capabilities. Each of the five capabilities is explained below:

Intellectual skills. Intellectual skills include facts, concepts, generalizations and problem solving abilities. As learners are presented with more and more information through instruction, they develop more sophisticated intellectual skills. Each intellectual skill is related to each other in that the more complex skills such as problem solving require prior learning of simpler skills.

The concept of how to negotiate many different types of terrains when driving a tractor across uneven ground or up and down hills is an example of an intellectual skill and a motor skill. The intellectual aspect of the terrain example is comprehending and applying information about inclines, speed and weight. The motor aspect is the actual maneuvering of the tractor.

Cognitive strategies. While intellectual skills are the "what" to learn, cognitive strategies are the processes of learning. The processes of inference or induction are examples of cognitive strategies.

Verbal information. Verbal information is communicated either orally or in writing. Through the use of simple questioning, teachers can assess verbal information and determine if learners are ready to progress to another aspect of learning.

Motor skills. Motor skills make possible the precise, smooth, and accurately timed delivery of performances involving the use of muscles. All vocational fields

require students to develop specific muscle or motor skills. Hammering a nail, typing a letter, administering an injection, sanding a board and driving a tractor are all examples of motor skills.

Attitudes. Through instruction students acquire preferences or attitudes toward people, events, activities and issues. An attitude of cleanliness is demonstrated by learners who sweep their work area and return tools and equipment to the appropriate location before leaving the wood-working laboratory.

Gagne thinks that each of these capabilities or learning outcomes must be considered before teachers design instructional units, lesson plans, or courses. He further believes that these capabilities will become more meaningful for the learner when they are taught simultaneously rather than separately. Gagne implies that the integration of materials such as the Arizona employability skills into on-going curriculum design is a better approach than making the teaching of employability skills as a single aim.

MATCH EVALUATION PROCEDURES TO LEVEL OF LEARNING OUTCOME

Gagne stresses that performance objectives are the keystone in planning assessment procedures. He believes that teachers should dissect major competencies into a hierarchy of well-defined skills or tasks. According to Gagne these specific skills or tasks serve as the basis for performance objectives and, in turn, the delivery of instruction.

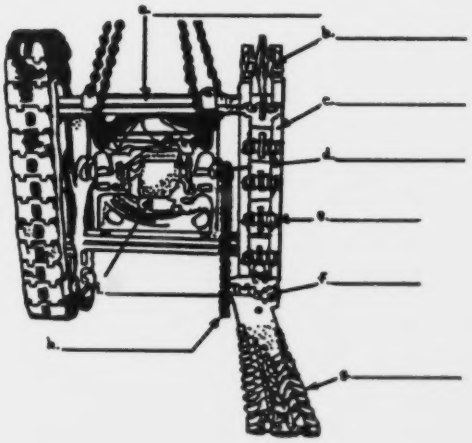
When teachers design evaluation procedures to assess student learning, the main question to ask is: "Is the behavior or performance required during the evaluation step the same level of performance as that described in the objective?" If the answer is "yes," then the evaluation procedure matches the level of learning outcome. For example, if "uses the decision making process to plan family expenditures" is the objective, the assessment procedure might ask learners to read a case study and then, using the decision making process, outline expenditures for

a specific family. This is an example of properly matched assessment procedures and learning outcomes. An example of an incongruent match for this objective would involve learners in only listing the decision making steps. Assessment at that level assesses only one skill (knows decision making steps), instead of the entire process of using the decision making process to solve a family finance situation.

Another example of a properly matched evaluation procedure and learning outcome or objective is listed below in Figure 4.

Figure 4. Examples of matched objective and evaluation.

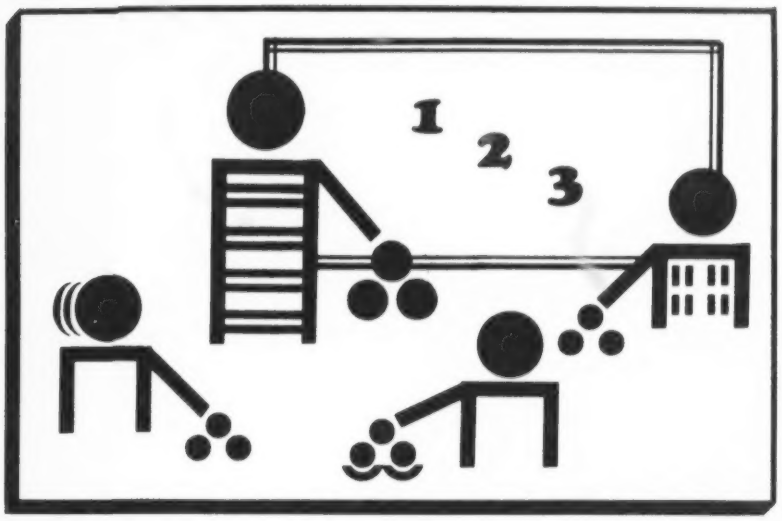
Objective	Evaluation
List the parts of a crawler cable crane.	Directions: Label each part of the following crawler cable crane.



(Source: Hendrix & Sawatzky, 1982, p. 43.)

Chapter 4.

Learning Principles & Theories of Albert Bandura



Albert Bandura's learning theory focuses on the interaction of individuals and their environment. His basic theory underscores the role of teachers as models. This chapter summarizes Bandura's main learning theories and offers suggestions for vocational education.

Bandura's Social Learning Theory

Albert Bandura attributes the largest part of learning to indirect experiences or vicarious learning. He stresses the impact of people on people. His work is based on studies of humans interacting with each other rather than rats in mazes or humans working with nonsense syllables (Hergenhahn, 1982). Thus his theory is called a social learning theory.

In explaining his theory, Bandura uses the word model to refer to anything that conveys information to an observer. This might be a person, a film, a picture, or television. He has conducted studies to demonstrate that learners will imitate not only the task being taught but also other behaviors of the model that are totally irrelevant to the task.

Bandura's theory suggests that much of the behavior that makes up our culture is transmitted by repeated observation of social models rather than being taught directly by reward and punishment of responses (Bandura,

1965). He explains that a learner may not exhibit an observed behavior until much later, a principle he calls "delayed modeling." According to Bandura once the capacity for social learning has been developed, it is impossible to keep people from learning that way (Bandura cited in Hergenhahn, 1982).

MODEL DESIRED LEARNING FOR STUDENTS

Teachers are often seen as influential models who should be able, through careful planning of presentations, to teach general rules, principles, performance standards, moral codes, and analytical and problem solving strategies, in addition to routine information (Hergenhahn, 1982). However, in addition to careful planning, the classroom teacher must be aware of unintentional cues being given to the student. According to Bandura's theory, the teacher is constantly modeling behavior for the student.

Essentially, Bandura's theory says, "actions speak louder or, at least, as loudly as words." Teachers may want their students to, "Do as I say, not as I do," but Bandura suggests that they are much more likely to do as the teacher does, not as the teacher says. Following Bandura's theory, teachers are important role models who have a lasting effect on students' concepts of behavior such as work attitudes, human relations, problem solving and conflict resolution.

In order for social learning to take place, models must attract and hold the observer's attention. Bandura's theory suggests that to be the most effective model the teacher must be respected and viewed by students as attractive, competent, and having status and power (Hergenhahn, 1982).

To be viewed as attractive by the students is not to say that teachers must look as if they just stepped off the page of a fashion magazine. Rather, teachers must be appropriately dressed for the classroom activity and at the same time give an indication of interest in their personal appearance. To be perceived as competent and having status

and power does not mean that the teacher needs to have all the answers or know all there is to know about a particular vocational area. If a teacher is well organized, has carefully planned classroom procedures and is willing to admit not having all the answers but knows where to find more information, the students will most likely view the teacher as competent, respected, powerful and as having status.

A natural concept for vocational education, which complements Bandura's theory of social learning, is that of mentoring or shadowing. A mentor is defined as a trusted counselor or guide and might also be thought of as a tutor or coach. In a mentoring program students are matched with someone in an occupation for a certain time period and actually spend the day on the job, by their side, thus the term shadowing. Following the social learning theory, care would have to be taken in selecting a mentor for the greatest effectiveness. The mentor should be matched to the student as closely as possible in characteristics such as gender, culture and background. In addition, the mentor, like the teacher who serves as an effective model, should be seen by the student as attractive, competent, respected, powerful and as having status.

ENHANCE POSITIVE FEELINGS ABOUT SELF

Bandura theorizes that self-reinforcement is a large part of learning. Self-reinforcement is derived from internalized standards of performance and conduct that have their roots in the individual's impression of what one is capable of doing. These impressions are developed by personal accomplishments and failures.

Individuals with positive feelings about themselves are better able to cope with stressful situations because they are able to direct their attention to the problem at hand rather than devoting energies toward their personal deficits and imagined potential problems. Verbal reinforcement can boost individuals' feelings about themselves enough to encourage them to try hard enough to

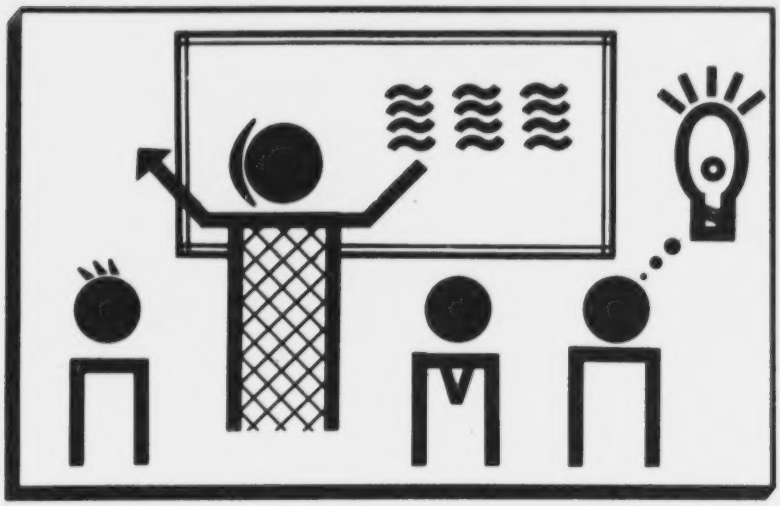
succeed and, in turn, promote skill development (Hergenhahn, 1982; Bandura, 1982).

It is generally agreed that the motivated employee is a valuable worker. Bandura credits motivation to self-reinforcement that is derived from internalized standards. These internalized standards, as explained by Bandura, relate to the individuals' perceived feelings about themselves and their ability to perform a task.

Following Bandura's theory, the vocational teacher has the ideal opportunity to strengthen students' feelings about themselves. This can be done through vocational youth group activities where teachers take students through difficult skills and encourage students to continue trying and finally to succeed.

Chapter 5.

Learning Principles & Theories of Jerome Bruner



For nearly three decades Jerome Bruner, a cognitive theorist, has been a leader in curriculum development. In this chapter, essential features of Bruner's curriculum contributions including discovery learning, intuitive thinking and concept teaching are summarized. Where applicable, examples for vocational education are noted.

Bruner's Discovery Learning

Bruner views discovery learning as the opportunity for learners to find out their own concepts, principles and solutions rather than receiving them from a teacher or textbook. Teachers enhance discovery learning by allowing learners to examine multiple possibilities and to try them out in a classroom environment which provides challenging experiences for individual learners. Discovery learning enables learners to apply what is learned in one learning environment to the mastery of new knowledge, skill or attitudes in another learning environment. This type of learning challenges students to learn how to learn in addition to assisting students in becoming independent, self-directed learners.

CHALLENGE LEARNERS TO THINK INDEPENDENTLY

For Bruner, the problem of how to teach learners to think independently and in such a way that they will use the learning material appropriately breaks down into several concerns. Each of these is summarized below.

Attitude. Learners must possess positive feelings about their own capabilities to learn. They must believe that they have the ability to solve problems and complete tasks. Teachers can promote supportive learner attitudes by first knowing the students' capabilities, interests and desires and then using this information to plan meaningful learning activities.

Compatibility. Compatibility focuses on the need for teachers to help learners associate new learnings to already learned knowledge, skills, and attitudes and to help fit these experiences into the students' own way of thinking. Teachers enhance compatibility and promote transfer of learning when they help learners make connections and recognize similarities and differences between new and previously learned behaviors. This "connectedness" between one unfamiliar learning event and another familiar learning event is illustrated by child development teachers when they use "flour babies" to teach learners about parental responsibilities. A flour baby is a 5 pound sack of flour that each child development student must treat as a baby for a week. During this experience students carry, dress and nurture the baby just as they would if they were truly responsible for a real child. This experience helps learners fit the concept of parental responsibilities into their own frame of reference.

Getting learners activated. In order for students to learn through discovery methods of instruction, they must be involved in the actual learning tasks. The best way to get learners involved is to design learning activities where each learner can experience some level of success. The ability to successfully perform an activity is self-rewarding. Learning activities that are poorly matched to learners' abilities, interests and resources do not promote learner involvement. An activity can be poorly matched if it is either too difficult or too simple for the individual learner.

Giving the learner practice. Learners need practice in developing various processes such as hypothesizing and drawing inferences. According to Rakes (1983, p. 1) teachers can help develop the thinking process of hypothesizing through the following teaching strategies: (1) provide clues before providing answers to questions; (2) acknowledge student responses with two or three seconds of eye contact; (3) allow students to formulate several answers and then choose the best response; (4) test joint responses from various learners by asking for the class to raise their hands if they agree with each response; (5) allow students five to seven seconds to answer questions; and (6) use the chalkboard to show questions, possible answers and the relationship between various questions and answers.

Handling information flow manageably. Learners become better managers of their own learning when they learn concepts and generalizations rather than learning facts through rote memorization.

Discovery learning experiences such as the following simulation in Figure 5 allows learners to examine issues, identify concerns and formulate solutions to problems.

Figure 5. Hospital advisory board simulation.

Directions: You are a Hospital Advisory Board. There is one available Kidney Dialysis Machine in your hospital. You have ten people who must be hooked up to the dialysis machine one hour from now or they will die. But, of course, only one can live. Your task: Select the one who will live (or the nine who will die).

A. Male Heart Surgeon; Age 55; Married; No children.

B. Male Insurance Salesman; Married; 2 Children; Age 32.

C. Female College Student; Age 20, Single.

D. Female Elementary School Teacher; Married; 1 Child; Age 27.

E. Female Minister; Age 58; Married; Children Grown-up.

F. 16 Year-old Girl.

G. Female Homemaker; Divorced; 2 Children; Age 26.

H. Male College Student; Married; No Children; Age 22.

I. Male Retired Air Force Colonel; Single, Age 49.

J. Male Politician; Age 36; Married; 4 Children.

Procedure:

1. Use any method of selection your group decides upon together.

2. Turn in one paper with all your names on it.

3. Rank-order your selection of the ten in order of the one that should be allowed the use of the machine first. (That way, in case the first one for some reason cannot use the machine, you will have a second choice ready). The last one on the list should be in your minds the last one to be "saved."

4. Explain why you picked #1 as you did. Please be specific about criteria utilized.

(Source: Jones et al., 1979, p. 43)

PRESERVE THE USE OF INTUITIVE THINKING SKILLS

Bruner reminds us that both intuitive thinking skills and analytical thinking skills are important for learners to master. Individuals in all fields of work need to use intuition (hunches, beliefs and insights) and analysis (facts, information and conclusions) to identify alternatives and to solve problems.

Intuitive thinking, where students discover reasons or answers for themselves, leads to a type of understanding that increases students' desire to learn and makes them more self-reliant in learning (Bruner, 1973).

When faced with insufficient evidence, intuitive thinking helps learners draw conclusions and make inferences-a main feature of intuitive thinking.

Teachers promote an environment for intuitive thinking not only through their teaching strategies, techniques and activities, but also through their attitudes.

The following teaching techniques promote intuitive thinking skills: (1) reduce excessive pressure for conformity; (2) teach students how to test for the worth of new ideas and help learners develop tolerance for new ideas; (3) develop an atmosphere in the classroom where new ideas are welcomed and rewarded; (4) praise and credit growth resulting from students' own efforts and initiatives; (5) honor students questions and assist them to find answers for their questions; and (6) provide opportunities for individual experimentation (Lacy, 1974, p.12).

TEACH CONCEPTS TO PROMOTE TRANSFER OF LEARNING

Concepts are groups or classifications of thoughts, ideas and events. For example, the major concepts in one

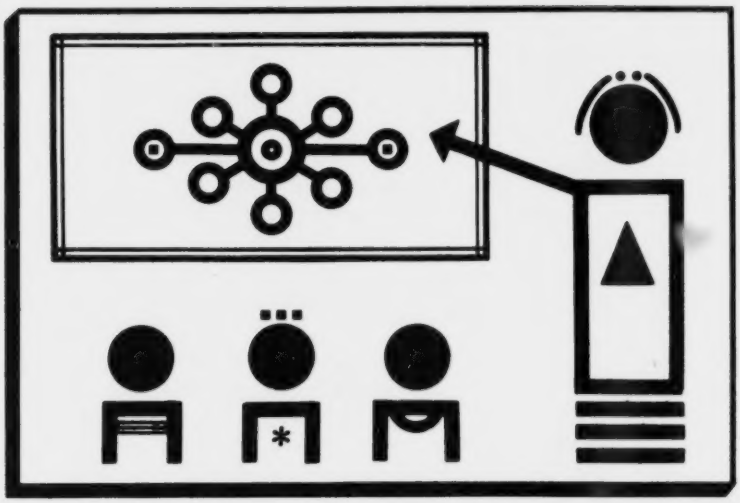
area of housing are: (1) housing provides the setting for the social development of individuals and family members and their interactions; (2) the family affects the neighborhood and its environment and, in turn, is affected by the neighborhood and its environment; (3) housing and its surroundings are status-defining for individuals and families (American Home Economics Association, 1967, p. 45).

According to Bruner effective learning occurs when students acquire a general understanding of a subject; that is, when they understand the structure of a subject, they see it as a related whole. They gain this understanding by building concepts, forming generalizations and seeing relationships between things (Bruner, 1975). When learners grasp concepts, they learn how things are related to one another and they are less likely to forget what they have learned.

Bruner specifies that educators need to break disciplines or subjects into broad concepts. He further believes that students need to learn basic, core concepts first and then gradually learn higher level concepts.

Chapter 6.

Learning Principles & Theories of David Ausubel



Ausubel contends that learners are more likely to approach learning tasks with enthusiasm if the task is meaningful to them and if it "fits" with their prior knowledge. The "advance organizer" is a technique proposed by Ausubel for creating meaningful learning. This chapter summarizes the essential elements of Ausubel's learning theory as it applies to vocational education.

Ausubel's Theory of Meaningful Learning

Ausubel's theory centers on the application of verbal learning which has meaning and purpose for the learner. His writings focus on how individuals comprehend, learn, organize, and remember verbal material. Ausubel (1969, p. 50) states that:

> ...the most important factor influencing learning is the quantity, clarity and organization of the learner's present knowledge. This present knowledge, which consists of the facts, concepts, propositions, theories and raw perceptual data that the learner has available to him/her at any point in time, is referred to as his/her cognitive structure.

ORGANIZE MATERIAL IN A FORM WHICH WILL BE MEANINGFUL TO STUDENTS

Ausubel (1960) proposes that students should be presented a brief introduction to the structure of information to be presented before they learn new concepts. He refers to such statements as "Advance Organizers," and suggests that they have the following characteristics: (1) They are more inclusive, abstract and general than the learning material. (2) They build on what learners already know. (3) They show the relationship between new material and what the learner already knows (Ausubel, 1969, p. 148).

Advance organizers, then, are organizing or anchoring ideas presented to the learner in advance of the body of material to be learned. For example, before students are taught the circulatory system, they could be presented with the following advance organizer statement: "The circulatory system is like the sanitary system of a city. In both there is a pumping station, pipelines with varying-sized pipes, a filtration plant, an exchange terminal, and capacity of disposal waste."

Advance organizers may be a brief written or oral presentation. They may be either expository or comparative. An expository advance organizer is useful when new material is totally unfamiliar to the student. These organizers help explain the unfamiliar material. Comparative organizers are useful when the learning task is not quite so unfamiliar. These organizers use similarities and differences to provide anchors for new material. The previous circulatory system example is a comparative advance organizer (Ausubel, 1969).

Teachers who use advance organizers help learners see new material as more familiar and, therefore, as more meaningful. When learning occurs in a meaningful way, learners are better able to store, recall and use the learned tasks.

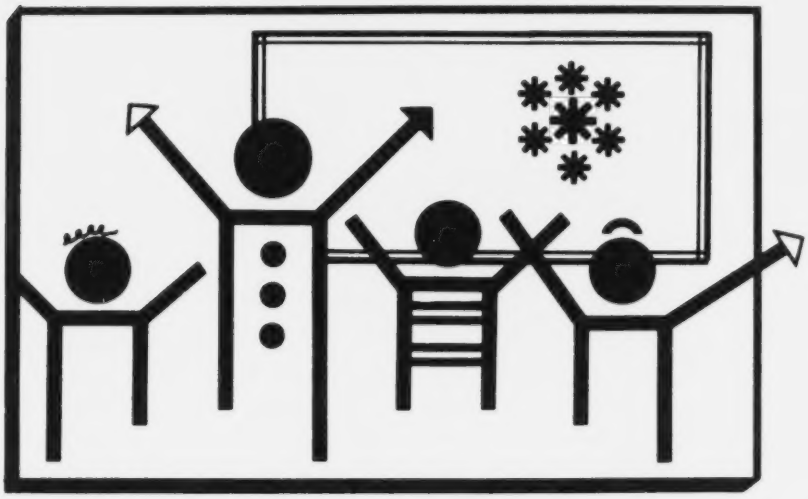
The role of the teacher is to know the subject area and its structure along with the students' level of knowledge about the content to be learned and to create an advance organizer lesson using both of these factors.

Advance organizers should provide a kind of mental scaffolding that allows less abstract ideas to be stored in the learners' minds as part of larger more abstract ideas.

When teachers show learners in advance about the way in which lesson units and lesson plans are organized and show learners the way in which sub-ideas fit with larger, more abstract ideas, they are using advance organizer techniques. Advance organizers help improve student comprehension, recall and their ability to use what they have learned.

Chapter 7.

Learning Principles & Theories of Carl Rogers



Carl Rogers advocates a humanistic approach to education where learners assume responsibility for their own learning. Two of Rogers' main principles of instruction are summarized in this chapter and examples for vocational education are noted.

Rogers' Humanistic Learning

Among the outcomes of education prized by humanistic educators are the learners' abilities to take more responsibility for determining what is to be learned and to become more self-directing and independent. These outcomes of humanistic education essentially focus on three ideas: (1) students learn what they need and want to know; (2) learning how to learn is more important than acquiring factual knowledge; and (3) feelings are as important as facts (Rogers, 1969).

INTERACT WITH STUDENTS IN A GENUINE, ACCEPTING AND EMPATHETIC MANNER

By communicating trust and respect through a genuine, accepting and empathetic manner, teachers create learning situations which maximize student growth. According to Rogers, these three traits of being genuine, accepting and empathetic are critical features for teachers to possess. Rogers stresses that teachers are more likely to be effective in promoting learning if they are honest and open and do not hide behind a facade. Teachers who are secure and able to laugh at themselves exhibit Rogers' trait of being genuine. The trait of acceptance is illustrated by the teacher who cares about the needs of learners. This trait is exhibited by teachers who are warm and possess positive feelings about other persons in general. Empathetic understanding is characterized by the teacher who can see a situation from the perspective of the student (Rogers, 1975).

The teacher traits of being genuine, accepting and empathetic are exhibited by teachers who recognize that individual learners have unique needs and concerns and that learners enter the classroom with prior experiences which need to be recognized and built upon. Allowing learners to use different methods of illustrating mastery of a given competency and encouraging learners to select meaningful competencies to be learned are examples of ways teachers exhibit a genuine, accepting and empathetic manner.

SHARE RESPONSIBILITY FOR CONTENT AND FORMAT OF LEARNING

Rogers (1971, p. 17) states that "schools should become exciting, funfilled centers of learning...." In order to reach this goal, he urges teachers to base learning activities and classroom instruction on the needs and desires of learners. Essential to his plan is the need

for the teacher to become a "facilitator of learning" not a teacher.

As a facilitator of learning, the teacher shares responsibility with the students for the content and format of learning. Thus, the teacher acts as a guide to learning, as a model of problem-solving, as a catalyst for initiating learning processes, as an aid in the process of learning, and as a friend to whom students can go to with their problems (Gage & Berliner, 1984).

The office simulation teaching strategy, where students role play actual office responsibilities, is an example of students and teachers sharing responsilibity for learning. Other approaches to shared responsibility are faciltated through individualized instruction and contract learning.

A contract is a tool which the learner and teacher write to define what learning will be accomplished, in a set time period, and for a certain grade. Below, in Figure 6, is an example of a contract.

Figure 6. A learning contract

LEARNING CONTRACT

Course _____

Name _____ Date _____

For the grade circled below, I am going to:	To exhibit my progress of requirements, I will:
A - Do an original research project as explained on attached sheet, plus completing all items for grade B,C, and D	Submit the outline of my paper to the teacher by _____ (Date) and the completed paper by _____ (Date)
B - Perform a case study as explained on the attached sheet, plus completing all items for grade C and D	Submit a case study to the teacher by _____ (Date)
C - Visit one of the following places and report completing the materials for grade D a. family style restaurant b. hospital kitchen c. gourmet restaurant d. catering service	Submit a 1-page handwritten personal reaction paper to to the teacher by _____ (Date)
D - Read textbook and pass three examinations	Passed examinations on _____ (Date) _____ (Date) _____ (Date)

_____ (Date) _____ (Student)

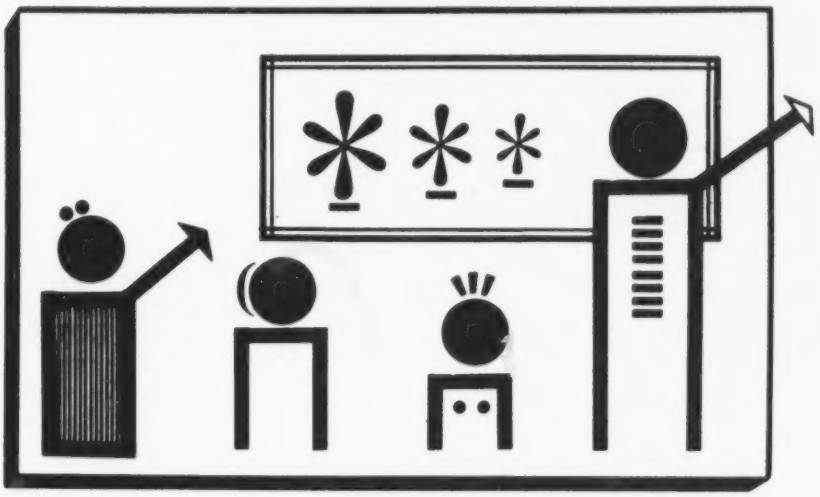
_____ (Date) _____ (Teacher)

_____ (Date) _____ (Parent)

(Jones et al, 1979, p. 31)

Chapter 8.

Learning Principles & Theories of Jean Piaget



Piaget views the learner's gaining of knowledge and competence as a result of growth and interaction with the physical and social environment. This chapter highlights Piaget's main theory of development and offers implications for curriculum and instruction.

Piaget's Developmental Stages

The psychologist whom educators most frequently cite is probably Piaget. His work is concerned with two aspects of intellectual development: how the mind develops and what particular intellectual structures are available to the learner at various stages of development.

MATCH LEARNING EXPERIENCES TO STAGE OF LEARNER'S DEVELOPMENT

Piaget is best known for his theory of stages in intellectual or cognitive development. According to Piaget the learner develops cognitively in a series of stages with each level of development dependent upon the successful completion of the preceding stage.

Piaget maintains that progression from one level of cognitive development to another is influenced primarily by four factors: maturation, physical experience, social experience and a process he calls equilibration. Equilibration is the process by which the mind takes in new information and "balances" the new ideas with previously learned information (Furth, 1969).

Piaget believes that "experiences" (both physical-manipulation of objects and logical-mental activities) contribute to the development of the learner's mental actions. These mental actions are organized into higher-level operations which are basic thinking processes individuals use to understand and act upon their surroundings (Boyle, 1969).

Since the individual learner's thought processes continually change and develop, educators need to both nourish that stage of development and provide the sort of correct match of learning experience that leads to the next stage of development for the learner (Varma & Williams, 1976).

Piaget's first two stages of development focus on the development of infants and young children. These stages are sensorimotor and preoperational. Sensorimotor covers roughly the ages from birth to two years and is characterized by the learner's attention to objects that are present and visible. For example, infants perceive that objects out of sight no longer exist.

During the preoperational stage, from approximately ages 2 to 7, the child becomes increasingly able to think as language develops and behavioral sequences can be played out in the head. At this stage even when objects are removed from sight, the young child retains a mental image of the object. children from ages 4 to 7 use language to develop concepts. They become able to form classes of objects and to see relationships. (Gage & Berliner, 1984).

Piaget's last two stages of development have particular implications for vocational education. These stages are concrete operations and formal operations. During concrete operations, approximately ages 7 to 11, the learner can see an event from different perspectives. Learners can sequence experiences into an organized whole. Concrete operational thinking has consistency and stability as compared with preoperational thinking.

While the growth of concrete operations is a growth in understanding of increasingly complex relationships, mental activity is still dependent upon perception of concrete objects that the learner has manipulated.

Giving learners a chance to touch, act, see and feel things helps them acquire an understanding of concepts and relationships. For example, having students hold a tough, over-manipulated pie dough in one hand and a light flaky dough in the other hand illustrates in a concrete way that manipulation influences dough quality.

To enhance learning, vocational teachers need to help learners deal with concepts close to their level of understanding before relating concepts to more abstract situations. For example, in a cooperative education class, the study of group dynamics could first be examined in terms of the learners' own classes and then related to their work situation before relating the concept to more distant examples.

As the pre-teen moves toward adolescence, the learner enters the world of ideas and abstractions. This stage is termed formal operations, according to Piaget, and roughly includes ages 11-14. This stage is further characterized by the learners' abilities to use thought to direct their observation (Varma & Williams, 1976).

The transition to formal operational thinking occurs around the seventh grade for "average" learners. However, students for whom English is a second language may not follow this timetable. Thus, teachers who work with special populations such as students with limited English skills may find that even though their learners have chronologically reached the point where more abstract reasoning abilities should develop, the learners, in fact, are still at what Piaget terms "concrete operations" or even "preoperational" stage of development.

As described by Piaget, intellectual development rests very largely on maturation. Differences in the students' ability to learn are attributed, at least in

part, to innate differences among learners. Moreover, Piaget believes that intellectual development may be slowed down by an unfavorable environment and accelerated by a more favorable environment.

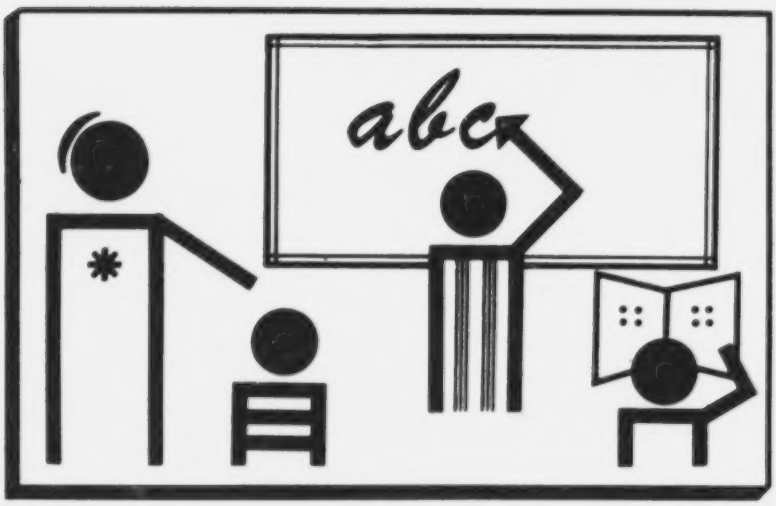
In terms of educational practice, Piaget's theory implies that the richness of the environment is crucial in maximizing learning. Specifically, Piaget believes that activity provides training for thought. Therefore, he believes we need to help young learners think in terms of increasingly complex relations, building from concrete "hands-on" experiences, to more abstract experiences.

An understanding of Piaget's principles of cognitive development will help vocational teachers make instructional decisions. Since abstract reasoning abilities are not well developed in most learners until the pre-teen to mid-teen years (ages 11 to 15), vocational teachers will want to forego such learning experiences as computer programming until the student has had sufficient concrete "hands-on" experiences to developmentally be ready for abstract thought processes.

As Piaget advocates, curriculum scope and sequence must match the level of learner development. Teachers cannot assume that all teen and adult learners are ready to use abstractions and make generalizations at the same time. Teachers must first recognize individual learner characteristics such as language capabilities, desire to achieve and richness of prior experiences. Then teachers need to match appropriate learning activities to the abilities of individual learners. This can be done by organizing curriculum units into levels such as level I (beginning), level II (intermediate) and level III (advanced). This allows teachers to select the correct match of learning experiences for the learners' abilities rather than assuming, for example, that all post-secondary students are at one level of learning.

Chapter 9.

Learning Principles & Theories of Robert Havighurst



Havighurst is best known for his stages of developmental tasks which he views as orderly, sequential and universal. Havighurst's theory of developmental tasks is discussed in this chapter and references are made to vocational classrooms.

Havighurst's Developmental Tasks

According to Havighurst, teachers need to recognize the developmental tasks which all individuals pass through as they develop from babyhood to old age. A developmental task is, "a task which arises at or about a certain period in the life of the individual, successful achievement of which leads to his happiness and to success with later tasks while failure leads to unhappiness in the individual, disapproval by society and difficulty with later tasks" (Havighurst, 1952, p. 2). Havighurst theorizes that teachers can better meet the needs of learners if they first identify and then use developmental tasks as a basis for curriculum decisions.

ALIGN LEARNING EXPERIENCES TO LEARNER READINESS

Havighurst contends that all learners progress through various stages during their lifetime. He perceives that these stages foster social, physical and emotional needs that must be met before students can continue to face new challenges and demands.

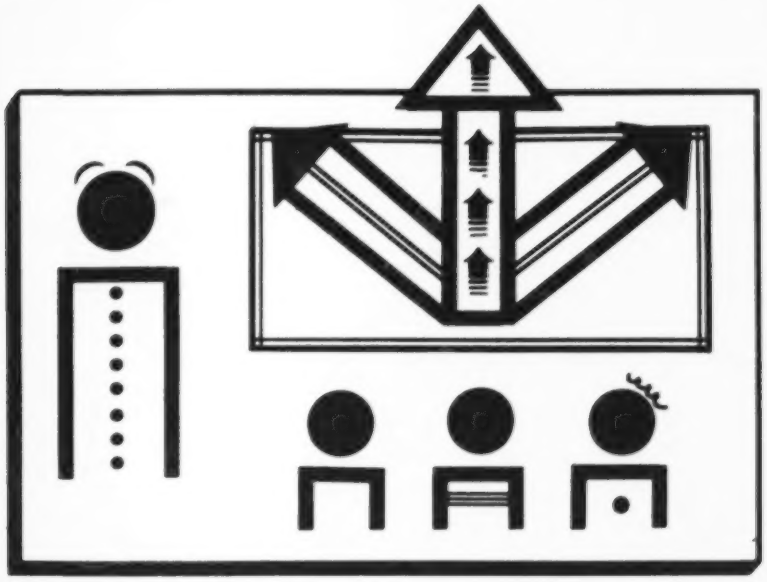
According to Havighurst, teachers need to recognize and understand developmental tasks so they can time teaching efforts to make the greatest impact on learning. Havighurst believes that teaching efforts may be wasted if they come earlier than the occurrence of learner readiness. Common developmental tasks for the adolescent period are: (1) achieving role concepts; (2) achieving emotional independence of parents and other adults; (3) achieving assurance of economic independence; and (4) selecting and preparing for an occupation (Havighurst, 1952).

When teachers provide opportunities which permit and encourage students to work on their developmental tasks, the total learning environment is enhanced. For example, teachers can help learners deal with the developmental task of "peer-group acceptance" by providing frequent opportunities for students to form into groups of their own choosing for committees, projects and panel discussions. Learners are assisted in realizing the developmental task of "achieving independence" when teachers plan for student-led discussions and when teachers encourage all students to express their viewpoints and feelings (Perkins, 1974, p. 408).

By gaining an understanding of developmental tasks and their relationship to learner needs, the classroom teacher can become more conscious of individual differences and can use this information when planning for instruction and learning. The more teachers understand the processes involved in instruction and learning, the more capable they will be of providing consistently effective teaching for all their students.

Chapter 10.

Implications for Future Vocational Education Curricula



A recent Arizona law has mandated that all Arizona vocational programs be competency based by the Fall of 1985. In a competency based program emphasis is placed on student attainment of industry-relevant skills, knowledge, and attitudes needed for entry into occupations. As a result of the competency based education movement in Arizona, there has been a great deal of effort placed on identifying what competencies and tasks will be taught in vocational classrooms. There is some concern by vocational educators that this has resulted in an emphasis on the "what to teach" to the point of ignoring the delivery or the "how to teach."

The purpose of this monograph is to examine learning theories and to apply these theories to vocational education. Moreover, this monograph is intended to serve as a guide for vocational educators in the practical application of learning theories to vocational education classrooms. Curriculum and instruction based on learning theories will help vocational educators balance the "what to teach" with the "how to teach" to keep vocational instruction current and fluid in meeting the needs of learners.

In the study of learning theories, it becomes evident that there is no single theory that will provide all the answers for education. Rather, each theorist makes a unique contribution to a broad theory of instruction.

Some theorists are concerned only with observable changes in learners. Other theorists focus on the process of learning and how teachers can facilitate this process. For easy reference, each theorist discussed in this monograph is summarized on the following pages.

Learning Principle 1:

Break learning into small steps organized into a logical sequence (Ch. 2, B.F. Skinner).

Summary. Organize content into well defined units and break down each unit into specific learning tasks. Sequence each learning task to build upon previously learned information.

Teaching tip. Use programmed textbooks and computer educational tutorial software to give students practice and immediate feedback. These techniques are especially helpful for learning tasks involving large quantities of factual information.

Learning Principle 2:

Provide frequent feedback to students (Ch. 2, B.F. Skinner).

Summary. Feedback reinforces learning. Let students know right away whether they have correctly learned a new concept. Provide frequent feedback spaced close to the learning experience.

Teaching tip. Grade and return quizzes and learning activities immediately. After students have mastered a learning task, follow-up frequently throughout the length of the course to check for retention of the desired learning.

Learning Principle 3:

Involve learners as active participants (Ch. 2, B.F. Skinner).

Summary. Students should be active rather than passive listeners or viewers. Elicit student responses during the learning process.

Teaching tip. Frequently check for understanding by interjecting questions or case problems to encourage active recall and application of new information.

Learning Principle 4:

Plan instructional sequences to parallel a hierarchy of learning (Ch. 3, Robert Gagne)

Summary. Recognize each stage or phase of the learning process and plan instructional strategies to incorporate each phase into classroom teaching.

Teaching tip. (1) Motivate learners to want to master new learning. Set learning experiences at a challenging level where students will feel that the desired learning is attainable. (2) Help learners focus on the new learning by providing attention-getting techniques such as bulletin boards, models, posters and pictures. (3) Use analogies to help learners connect new learning to ideas they already possess. (4) Provide opportunities for learners to recall new learning. (5) Teach rules or generalizations rather than promoting rote memorization. (6) Provide appropriate practice for learners. (7) Tell learners how they are doing.

Learning Principle 5:

Arrange skills to be learned from simple to complex (Ch. 3, Robert Gagne).

Summary. Organize content from simple to complex learning. Teach students simple learning tasks before teaching more complex behaviors.

Teaching tip. Teach from a planned scope and sequence divided into levels of learning. Teach students beginning learning tasks from level 1 before teaching intermediate (level II) and advanced (level III) behaviors. For example, in vocational agriculture students would learn how to feed animals before learning how to balance a ration.

Learning Principle 6:

Recognize multiple aims for instruction (Ch. 3, Robert Gagne).

Summary. There are many aims or outcomes for learning. Learning involves mental, motor and attitudinal changes. Learning also involves processes of grasping and using information.

Teaching tip. Integrate the teaching of knowledge, motor skills and attitudes into all units of instruction. Also, teach processes of learning such as the use of inference and inductive reasoning.

Learning Principle 7:

Match evaluation procedures to level of learning outcome (Ch. 3, Robert Gagne).

Summary. Assess new learning at the same level of difficulty as the desired learning outcome.

Teaching tip. When selecting evaluation procedures, ask this question, "Is the behavior or performance required during the evaluation step the same level of performance as that described in the objective?" If the answer is "yes" then the evaluation procedure matches the level of learning outcome.

Learning Principle 8:

Model desired learning for students (Ch. 4, Albert Bandura).

Summary. Teachers and other significant adults serve as role models for learners. Students learn knowledge, skills and attitudes through modeling.

Teaching tip. Place students in business and industry for shadowing opportunities. Shadowing experiences expose students to industry relevant knowledge and skills in addition to desirable work attitudes.

Learning Principle 9:

Enhance positive feelings about self (Ch. 4, Albert Bandura).

Summary. The way learners feel about themselves influences their ability to learn.

Teaching tip. Plan challenging learning experiences for students supported by teacher praise. Use the organization of vocational youth groups to help students build positive feelings about themselves.

Learning Principle 10:

Challenge learners to think independently (Ch. 5, Jerome Bruner).

Summary. Discovery learning techniques challenge students to learn how to learn in addition to assisting students in becoming independent, self-directed learners. Through discovery learning, students examine issues, identify concerns and formulate solutions to problems.

Teaching tip. Promote discovery learning by: (1) Helping students feel good about themselves, (2) Fitting new learning into the student's own frame of reference, (3) Challenging learners at their individual level of need, (4) Helping learners practice processes of learning such as hypothesizing, and (5) Teaching rules and generalizations rather than relying on rote memorization.

Learning Principle 11:

Preserve the use of intuitive thinking skills (Ch. 5, Jerome Bruner).

Summary. Respect both the mental or analytical and the feeling or intuitive processes of learning. Creative solutions to problems require both analytical and intuitive skills.

Teaching tip. Promote intuitive thinking skills by: (1) Reducing excessive pressures for conformity, (2) Teaching students how to test for the worth of new ideas and helping learners develop tolerance for new ideas, (3) Developing an atmosphere in the classroom where new ideas are welcomed and rewarded, (4) Praising and giving credit

for students' efforts and initiatives, (5) Honoring students' questions and assisting them to find answers for their questions and (6) Providing opportunities for individual experimentation (Lacy, 1974, p. 12).

Learning Principle 12:

Teach concepts to promote transer of learning (Ch. 5, Jerome Bruner).

Summary. Teach students the underlying structure of a subject field by teaching concepts, rules and generalizations rather than relying on rote memorization. Concept attainment promotes transfer and retention of learning.

Teaching tip. Plan instructional units around concepts, rules or generalizations. An example of a concept is, "high moisture foods wilt and dry out in the freezer." An example of rote memorization is, "Don't freeze lettuce, tomatoes, and cucumbers."

Learning Principle 13:

Organize material in a form which will be meaningful to students (Ch. 6, David Ausubel).

Summary. Present a brief introduction to the structure of information to be presented before teaching students new concepts.

Teaching tip. Provide mental scaffolding that allows learners to relate less abstract ideas to more abstract ideas. Use advance organizers to introduce new information to learners. For example, before students learn about the circulatory system, they could be presented with the following advance organizer statement: "The circulatory system is like the sanitary system of a city. In both there is a pumping station, pipelines with varying-sized pipes, a filtration plant, an exchange terminal, and capacity of disposal waste."

Learning Principle 14:

Interact with students in a genuine, accepting and empathetic manner (Ch. 7, Carl Rogers).

Summary. When teachers express concern and interest in learners, learners are more likely to develop to their maximum learning potential.

Teaching tip. Get to know learners as individuals with unique learning needs. Talk with learners' parents and other teachers to find out how learners interact in settings outside the classroom. Invite administrators, business and industry representatives and parents to attend specific classroom events. Use these individuals to judge contests and to supervise out of class events.

Learning Principle 15:

Share responsibility for content and format of learning (Ch. 7, Carl Rogers).

Summary. Students and teachers together are responsible for selecting, planning, implementing and evaluating learning.

Teaching tip. Act as a facilitator of learning rather than a teacher. Allow students to select content and competencies which they view as most meaningful to their development. Encourage students to select from a range of learning and to evaluative experiences.

Learning Principle 16:

Match learning experiences to stage of learner development (Ch. 8, Jean Piaget).

Summary. As learners mature, they develop increasingly more complex mental abilities. Match the level of individual learners' abilities to appropriate learning and evaluative experiences.

Teaching tip. Recognize each individual learner's stage of development and plan experiences to match their level of readiness for the learning task. Use concrete experiences to teach abstract ideas. For example, when teaching vocational agriculture students how to determine fertilizer application per acre of alfalfa, take students to an experimental farm to actually see the fertilization process. When this is not possible, use case studies so students become actively involved in a concrete way in solving problems regarding fertilizer application.

Learning Principle 17:

Align learning experiences to learner readiness (Ch. 9, Robert Havighurst).

Summary. All individuals progress through similar developmental tasks. Meet the needs of learners by first identifying and then using developmental tasks as a basis for curriculum decisions.

Teaching tip. Plan instructional processes to fit the learner's developmental stage. For example, promote the developmental task of "achieving independence" by planning for student led discussions in addition to encouraging students to express their viewpoints and feelings.

As we examine the major principles proposed by learning theorists, we see a recurring theme of concept development. Repeatedly, theorists call for educators, as engineers of the instructional process, to break a subject into major concepts and to teach toward the development of these concepts. In essense, our competency based education thrust in Arizona is an attempt to examine, analyze, and describe a content area or occupational cluster. The aim of vocational educators is the identification of major principles, rules, concepts or generalizations in a given discipline. These statements, in conjunction with performance objectives, supported by competencies serves as the basis for future vocational education curricula. This monograph has been compiled to serve as an instructional tool to promote excellence in learning and to meet the emerging educational needs of vocational students in Arizona.

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